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Report of the fourth session

FAO EXPERT PANEL FOR THE FACILITATION OF TUNA RESEARCH

La Jolla, California, U.S.A., 8 - 12 November 1971

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ROME, 1972

REPORT OF THE FOURTH SESSION OF THE FAO PANEL OF EXPERTS FOR THE FACILITATION OF TUNA RESEARCH

La Jolla, California, U.S.A., 8–12 November 1971

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, April 1972

PREPARATION OF THIS REPORT

This is an edited and approved version of FIR:EPFTR/71/12 as amended at the closing session of the Panel and which incorporates various reports of Working Parties of the Panel, as well as documentation prepared for the Fourth Session by some members of the Panel.

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1. PROCEDURAL MATTERS

1.1 General

The FAO Panel of Experts for the Facilitation of Tuna Research convened at the Southwest Fisheries Center of the National Marine Fisheries Service, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, La Jolla, California, from 8 to 12 November 1971, with Dr. A. Suda (Japan) as Chairman. Dr. F.J. Hester (U.S.A.) was elected Rapporteur. All members of the Panel were present with the exception of Professor E. Postel (France) who was unable to attend. A list of officers, members and guests is given in Appendix 4.

1.2 Agenda

The following agenda was adopted:

1. Opening
2. Adoption of the agenda and arrangements for the Session
3. Review of Panel activities
4. Scientific basis for management of tuna resources
   - (a) Catch and effort data requirements
   - (b) Species identification
   - (c) Stock identification
   - (d) Stock assessment
5. Other activities
   - (a) Billfishes
   - (b) Use of environmental data for forecast systems
   - (c) Species Synopses
   - (d) Other
6. Collaboration with other bodies concerned with tuna research and management
7. Any other matters
8. Election of officers
9. Date and place of Fifth Session
10. Adoption of report
11. Adjournment

1.3 The work of the Panel

The Panel met in plenary sessions and reviewed the present status of tuna research in the world. The reports of various Working Parties of the Panel were discussed in light of the recommendations made by the Panel during its Third and earlier Sessions, and also reviewed were a number of other documents which were made available by the members of the Panel, the Secretariat and FAO staff members and other sources. A list of documents is given in Appendix 5.

During the Session the participants had the opportunity to tour the Southwest Fisheries Center, La Jolla Laboratory and to visit Seaworld, a research oceanarium in nearby San Diego. The Panel members also had the opportunity to discuss various aspects of tuna research with the members of the Southwest Fisheries Center, the Inter-American Tropical Tuna Commission and the Scripps Tuna Oceanography Research Program.

1.4 Officers

The Panel unanimously elected Dr. J. Joseph (U.S.A.) Chairman and Dr. J. Le Guen (France) Vice-Chairman for the interim period until the Fifth Session and for the Fifth Session.

1.5 Date and place of the Fifth Session

In view of the established practice of holding the Panel sessions at localities where tuna fishing research is conducted, the Panel recommended to the Director-General that the Fifth Session of the Panel be held in Africa, perhaps Abidjan, in early 1974.

2. CONCLUSIONS AND RECOMMENDATIONS OF THE PANEL

2.1 General

The Panel began its Session with a tribute to two colleagues, Drs. H. Nakamura (Japan) and M.B. Schaefer (U.S.A.) who passed away during the intersessional period.

2.2 Relations with the Advisory Committee for Marine Resources Research (ACMRR)

The Panel re-endorsed its request that FAO continue to inform ACMRR on its activities and decided that the Panel Secretary should provide the necessary link.

2.3 Appointment of a billfish expert to the Panel

The Panel was pleased to note that its request that a billfish expert be appointed to the Panel had been carried out and welcomed Dr. S. Ueyanagi (Japan).

2.4 Working Party on Research on North Pacific Albacore and Bluefin Tuna

The Panel noted that because close cooperation exists on a permanent basis among the laboratories comprising this Working Party and their activities are reported separately to the Panel or through other Working Parties, the need to continue this Working Party no longer exists and it should be disbanded.

2.5 Tuna and billfish tagging in the Pacific and Indian Oceans

The Panel considered and accepted a Second Report from the Working Party on Tuna and Billfish Tagging in the Pacific and Indian Oceans (to be published as a supplement to this report). It noted recommendations from Dr. W. Bayliff (U.S.A.), Convener, for further activities of his Working Party and accordingly recommended that:

(a) extensive skipjack tagging should be conducted in the central and western Pacific;

(b) other species of tuna, particularly yellowfin, should be tagged whenever opportunities present themselves, during the carrying out of the skipjack tagging work;

(c) the historical tagging data from the northern bluefin (Thunnus thynnus orientalis) programme and the southern bluefin (Thunnus maccoyii) programme should be analysed and published.

With regard to (c) the Panel strongly recommended that FAO stimulate in whatever way possible the speedy analysis and publication of the results of the northern bluefin tagging programme of the National Marine Fisheries Service and the California Department of Fish and Game (U.S.A.) and also the southern bluefin tagging programme of the Commonwealth Scientific and Industrial Research Organization (Australia).

2.6 Tuna and billfish tagging in the Atlantic and adjacent seas

The Panel considered and accepted the Report from the Working Party on Tuna and Billfish Tagging in the Atlantic and Adjacent Seas. Noting that the International Commission for the Conservation of Atlantic Tunas (ICCAT), through its Sub-Committee on Stock Identification, was now coordinating and facilitating tuna tagging in the Atlantic, the Panel thanked the Working Party and its Convener and agreed that it be dissolved. The final report of the Working Party will be published as a supplement to this report.

The Panel reiterated its earlier recommendations calling for (a) increased tagging of bluefin in the Mediterranean, and (b) when possible, the inclusion of catch and effort data with tag return data.

In view of the importance of the Bay of Biscay as the only major fishing ground for young bluefin tuna (2.5 - 50 kg) in the eastern Atlantic, and the general decline of the eastern Atlantic bluefin fisheries, the Panel strongly recommended that the tagging of small bluefin tuna in the Bay of Biscay be resumed on a large scale and on a continuing basis.

The Panel noted that this action is also needed to obtain better knowledge of the interaction between the northwestern Atlantic and Bay of Biscay stocks of young bluefin tuna. The Panel asked the Chairman to bring this recommendation to the attention of ICCAT.

2.7 Tuna and billfish taxonomy

The Panel received a request from Dr.R.H. Gibbs (U.S.A.), Convener of the Working Party on Tuna Taxonomy, that he be relieved of his responsibility as Convener. The Panel thanked Dr. Gibbs and accepted his resignation. It agreed that Dr. B.B. Collette (U.S.A.) be appointed Convener in his place. The Panel decided to change the name of the Working Party to include billfishes.

The Panel heard the report of the Working Party. The Working Party is now in a position to revise the bonitos (Sarda), a group of species that is under-exploited on a world-wide basis. It is also looking into the long-term taxonomic problems of the tropical Indo-Pacific species of Scomberomorus and is continuing to make progress on billfish systematics. The Panel urged that priority be given to Sarda.

The Panel further recommended that the Working Party contact individual workers for specimens still lacking at the Center for the taxonomic study of tuna at the U.S. National Museum in Washington, D.C. and also, through FAO, attempt to obtain additional material from appropriate FAO field projects.

With regard to the previous recommendation of the Panel that the Working Party be expanded to include additional experts from other fields, the Panel concurred with Dr. Collette's request that only one additional expert be added at the present time, Dr. Roger F. Cressey, Division of Crustaceans, National Museum of Natural History, Washington, D.C., who is working on copepod parasites of tunas and billfishes with special emphasis on the western Atlantic and the Indian Ocean.

The Panel realized that the possibility exists of using parasite occurrence as indicators of phylogenetic relationships and as natural tags for sub-populations. It therefore requested that, wherever possible, parasitic copepods from tunas, tuna-like species and billfishes should be made available to Dr. Cressey.

2.8 Guide to the marks used for tunas and inventory of tuna tagging programmes

The Panel noted with satisfaction that FAO published the revised version of the Guide. It was agreed that some further amendments were required, and the Panel invited Dr. Bayliff and Mr. Mather to advise the Secretariat on this matter.

The Panel reiterated its earlier recommendation that a supplementary part on billfish tagging should be prepared and invited Mr. Mather, in conjunction with the Secretariat, to obtain relevant information during the forthcoming International Billfish Symposium in Hawaii and from other sources.

2.9 Tuna eggs, larvae and juveniles

The Panel considered a report from the Working Party on Tuna Eggs, Larvae and Juveniles (Appendix 1) which included information on the recent larval tuna workshop in Honolulu, Hawaii. It noted that the proceedings of the workshop will be published in the Fisheries Bulletin of the National Marine Fisheries Service. The Working Party is continuing its work on the clarification of some of the species whose identification is still in doubt at very early stages in their life history. In addition, attention is being given to the problem of verification of identification by hatching and rearing the larvae; also increased efforts will be made to clarify the difficult identification of juvenile stages and eggs. The Panel thanked the Working Party for its progress to date and concurred with the priorities set for future work.

2.10 Early life history of the billfishes

In response to the importance placed on billfish by the Panel at the previous session, it was decided to establish a Working Party on the Early Life History of the Billfishes, with Dr. Ueyanagi (Japan) as Convener. The Panel recommended that the terms of reference for this Working Party be:

(a) the identification of eggs, larvae and juveniles of billfishes and the development of keys for their identification;

(b) investigation of better methods for collecting larvae and juveniles; and

(c) studies of the distribution of the early life stages of the billfishes on a world-wide basis.

The Panel recognized that it will take several years to carry out this work and suggested that the Working Party cooperate closely with the Working Party on Tuna Eggs, Larvae and Juveniles.

2.11 Scientific basis for management of tuna resources

The Panel noted that there is an urgent and increasing need in all three oceans of the world for proper management and rational exploitation of the tuna resources. It agreed that measures to achieve this goal must be based on sound scientific information. In order to facilitate the implementation of urgently required further research activities world-wide or in specific areas, the Panel decided to arrange for the preparation of Priority Tables which would summarize such research needs for various tuna species in each of the three oceans. The Panel established for this purpose a Working Party consisting of Dr. J.C. Le Guen as the Convener, Dr. J. Joseph and Dr. A. Suda, and agreed that the Working Party would provide the Secretary before the end of April 1972 with draft tables for circulation to all members of the Panel for their comments. Dr. B. Collette agreed to advise the Working Party on matters related to tuna and billfish taxonomy.

2.12 Catch and effort data requirements

The Panel reviewed available tuna catch and effort statistics and FAO's efforts to assist in their collection and publication. It considered the table of nominal catches, by species, fishing areas and countries of tunas, bonitos, billfishes, etc. for 1964-70 (FAO Fish. Circ. No. 289), and commended FAO for the continuing improvement of this reporting system. Panel members were asked to provide the Secretariat by 1 December 1971 with any amendments. The Panel was also pleased to note that the collection of Atlantic tuna statistics has recently been greatly improved through the efforts made by the ICCAT Secretariat with the publication of their Statistical Bulletin series.

With reference to tuna catch and effort statistics, the Panel recognized difficulties in collecting these statistics and the particular problem arising from surface fishing which requires especially fine reporting on an areal basis. The Panel, realizing the varying requirements for areal coverage for different fisheries, recommended that:

(a) reporting should use the smallest unit of area consistent with the behaviour of the exploited stocks and the several constraints placed upon this type of work;

(b) 1° squares should be used, if possible;

(c) countries should make every effort in ensuring speedier submission of tuna catch and effort statistics for publication by FAO and ICCAT.

2.13 Species identification

The Panel considered the continuing problem of species identification, recognizing that this is a two-part problem: first, the general problem of identification of species for market statistics; and second, the preparation of Species Identification Sheets for Statistical Purposes for publication by FAO in the relevant series.

At its Third Session the Panel had asked that the Convener of the Working Party on Tuna Taxonomy arrange with the Secretariat for the preparation of Species Identification Sheets for tunas. It has not been possible for the Working Party to take any specific action on this matter. However, in view of the plans by ICCAT to publish a Field Manual for Statistics and Biological Sampling of Atlantic Tunas which will include descriptions and identification keys for the various tuna and related species, the Secretariat arranged for an agreement with ICCAT on the preparation of Species Identification Sheets for the Atlantic Ocean as part of that activity.

The Panel was pleased to note that the Convener of the Working Party on Tuna and Billfish Taxonomy is agreeable to collaborating with Dr. S. Hayasi and the Assistant Executive Secretary of ICCAT on this subject and recommended that the Convener of the Working Party finalise with Dr. Hayasi and Dr. M.P. Miyake the drafting of identification sheets for the Atlantic species.

It was also agreed that the Convener of the Working Party on Tuna and Billfish Taxonomy, in cooperation with the Secretariat and the Editor of the FAO Species Identification Sheets, would arrange for the preparation of such sheets for the Indo-Pacific species, ensuring the collaboration of specialists in this field.

With regard to the general problem of identification of tunas and related species for statistical purposes, the Panel noted that the Species Identification Sheets will help to improve the situation; however, it recognized that much of the problem results from marketing practices that do not separate the species at the time of sale, and urged that reporting countries make increasing efforts to correct these deficiencies.

2.14 Stock identification

Dr. Ueyanagi (Japan) reviewed for the Panel the current knowledge on stock separation of tunas. The Panel was impressed with the complexity of the problem, particularly with respect to the tropical tunas. The Panel advised that there is a need for encouragement of an interdisciplinary approach including tagging, morphometrics, genetics, parasitology, pollution studies, etc., and stressed the need for integration and close coordination of all these methods.

The Panel was informed that the Tuna Serological and Biochemical Center at the NMFS Honolulu Laboratory has been discontinued and that future immunogenetic and biochemical sub-population work by NMFS was as yet undecided. Recognizing this fact and that considerable methodological problems need to be resolved, the Panel does not recommend the designation of a replacement to the Serological and Biochemical Center at this time.

With regard to the use of parasites for stock identification, the Panal expressed its desire to be kept informed of progress by workers in this field through the Working Party on Tuna and Billfish Taxonomy and Dr. Le Guen.

The Panel considered the establishment of priorities for stock identification of major tuna species and recommended that stock identification problems for (a) North Atlantic, Mediterranean and Black Sea bluefin, (b) yellowfin tuna on a world-wide basis, (c) albacore in the Atlantic and Indian Oceans, (d) Sarda chiliensis, and (e) bigeye (tagging in the home island fishery of Japan), be given high priority.

With regard to the billfishes, the Panel did not feel that stock identification work need be given high priority for the commercial fisheries but is important for resolving sport-commercial conflicts and should be encouraged.

2.15 Stock assessment

The Panel reviewed current information pertaining to the assessment of stocks of tuna and billfishes throughout their range, and the effect that exploitation by man may be having upon their abundance.

Detailed discussions were held concerning particularly the fisheries in the Atlantic and eastern tropical Pacific Oceans. A review was presented of the southern bluefin fishery, and the management programme recently implemented by the Japanese to control the average size at first capture of this species was discussed. The Panel commended the Japanese fishing industry on the implementation of their management programme for southern bluefin tuna and encouraged its continuation.

The Panel also pointed to the specific need to accelerate data gathering and research covering the dynamics of the fisheries for tuna in the Indian and western Pacific Oceans. It noted with satisfaction the publication by FAO of the volume "The Fish Resources of the Ocean" (FAO Fish.tech.Pap. No. 97) prepared as part of the Perspective Study of World Agricultural Development (PSWAD), previously known as the Indicative World Plan for Agricultural Development (IWP), which includes estimates of potential yields from the tuna resources of the world. The Panel encouraged FAO to continue to update and improve the estimates as new information becomes available, and in this respect called attention to the apparently great relative abundance of Auxis spp. throughout the oceans of the world.

2.16 Billfishes

Dr. Ueyanagi (Japan) reviewed the billfish fishery in Japan with some comments on future research needs (Appendix 2). The report pointed out the necessity for an agreement on standardized length measurements of billfishes. This matter is to be discussed at the forthcoming ICCAT meeting and the Panel recommended that Dr. Le Guen and the Secretary, attending that meeting, should report the outcome to the Chairman.

Dr. F. Williams (U.S.A.) reported to the Panel on the arrangements for the International Billfish Symposium to be held at Kailua Kona, Hawaii from 9 to 12 August 1972, under the sponsorship of the U.S. National Marine Fisheries Service. The Panel noted with satisfaction the plans for such a symposium and expressed hope that the countries engaged in billfish research, particularly Japan and the U.S.S.R., would be well represented. The Panel recommended that FAO attempt to provide travel for one or two key people from developing countries to this symposium and that FAO, through its international contacts, assist in publicizing this meeting. The Panel also suggested that FAO, as far as possible, arrange for appropriate field project personnel to attend.

2.17 Use of environmental data for forecast systems

The Panel was pleased to receive a briefing and tour by Dr. N. Clark of the Fishery Forecasting Program of the Southwest Fisheries Center. Dr. Clark discussed the experimental and operational aspects of this programme. The Secretary called the Panel's attention to a report on applications of remote sensing for fisheries research and development and to fishing operations prepared for ACMRR. This report is to be issued shortly by FAO. The Panel noted the importance of this type of activity and encouraged further and continuing efforts in this general field.

The question was raised as to the desirability of establishing a Working Party to summarize the present state of the uses of environmental data in experimental tuna forecasting systems and to suggest future work. The Panel decided that it would be premature to establish such a Working Party at this session. However, in view of the importance of this work, and taking into account the general rotation of Panel membership, the Panel proposed that the Director-General of FAO should consider the appointment of an expert in this field to the Panel.

For the intersessional period, the Panel invited Drs. M. Laurs (NMFS Southwest Fisheries Center, La Jolla) and F. Williams (Scripps Tuna Oceanography Research Program, La Jolla) to provide the Secretary as soon as possible with recommendations for:

(a) future activities in this field, with a special view to expanding this type of work into other tuna fishing areas;

(b) kind of data required and possible ways of collecting them;

(c) advice to be presented from the Panel to the various regional, national and international oceanographic and environmental programmes, such as the international cooperative investigations in the Caribbean (CICAR), the Mediterranean (CIM), in northwest Africa (CINECA), and the International Decade for Ocean Exploration (IDOE), on the collection and use of environmental and biological data directly applicable to tuna fisheries and research.

2.18 Species Synopses

The Panel discussed the problems of publishing revised Species Synopses for tunas, tuna-like species and billfishes and noted with pleasure a tentative offer to FAO from the National Marine Fisheries Service to publish them. The Panel was informed that, in connexion with the International Billfish Symposium, Species Synopses for all the billfishes would be prepared by various authors and published by NMFS. With regard to the tunas and related species, it was the consensus of the Panel that highest priority for revision be given to the six major exploited species: yellowfin, bigeye, bluefins, albacore and skipjack. Details are shown in Appendix 3. With regard to authorship of these synopses, it was decided to leave the selection of authors to the FAO Editor in consultation with the Panel Chairman and Secretary. The Panel recommended that authorship should be multiple to ensure adequate coverage on a world-wide basis.

2.19 Marine pollution

The Panel was given a review of international activities in the field of marine pollution, such as the FAO Technical Conference on Marine Pollution and its Effects on Living Resources and Fishing (December 1970) and its follow-up, the Oslo Conference on Marine Pollution (October 1971), and the preparations for the UN Conference on the Human Environment (1972).

The Panel, considering the problems of mercury contamination of tunas and related species, noted that the apparent relation of fish size and mercury content was probably causing changes in fishing strategy that would create problems in evaluating the conditions of the various stocks of tunas.

The Panel recommended that FAO should encourage studies of mercury uptake and excretion in marine fishes, especially tunas, and should, in collaboration with other organizations concerned, facilitate further studies on the effects of mercury in fish on consumers and on the economy of fisheries in general.

The Panel discussed possibilities of using museum-held collections of tunas and billfishes for investigations on the contents of mercury and other contaminants in such fishes to provide a history of these contaminants in the marine environment. The Panel invited the Convener of the Working Party on Tuna and Billfish Taxonomy to prepare a résumé on the availability of such museum-held collections in various parts of the world which might be analysed for this purpose.

The Panel recognized the international nature of this type of research and that a careful review of analytical methodology will be required.

Noting the plans for the retrospective monitoring of selected pollutants in historical collections of marine organisms which were developed recently by the joint ACMRR/SCOR/ACOMR/GESAMP Working Party on Global Investigation of Pollution in the Marine Environment (GIPME) during its meeting in San Marco di Castellabate and Rome, October 1971, the Panel recommended that ACMRR, at its next session, should review this problem and elaborate a programme of activities in this field. In view of the particular bearing contaminants have on the tuna and billfish fisheries, the Panel strongly urged that the feasibility of this project be reviewed speedily.

2.20 Tuna culture

The Chairman reviewed the subject for the Panel and pointed out that attempts to culture tunas provide both an opportunity to increase production of these species as a high-priced commodity for some nations and information on their life history and physiology. The Panel recommended to FAO that such work be encouraged and information regarding the results of this work be disseminated as speedily and widely as possible, including, when appropriate, publication in the FAO Aquaculture Bulletin.

2.21 Tuna baitfish

The Panel considered the necessity for including the numerous species of tuna baitfishes in its area of concern. It concluded that these baitfishes are an important problem in the field of tuna research, particularly for the development of new fisheries. The Panel recognized a world-wide need for improved catch and effort statistics for these species with emphasis on the time-area stratification problem of dealing with short-lived fishes of limited distribution.

The Panel also recognized the taxonomic problems that exist with the Indo-Pacific species and expressed its appreciation to Dr. P. Whitehead (U.K.) for his work on the clupeoids and his cooperation with field workers in the Indo-Pacific region. The Panel recommended that work on Indo-Pacific species be supported through:

(a) provision of specimens from the field to be coordinated by the Convener of the Working Party on Tuna and Billfish Taxonomy;

(b) efforts by the Secretariat to include tuna baitfish species in the FAO/DANIDA Workshop on Fish Taxonomy in Southeast Asia envisaged for December 1972 in Thailand; and

(c) the inclusion of bait species in the FAO Species Identification Sheets series.

2.22 Development and use of underwater sound in tuna research

The Panel reconfirmed its previous recommendation that with the help of the past Convener of the Working Party, Mr. H.S.H. Yuen (U.S.A.), the Secretariat of the Panel provide the Panel members from time to time with a brief report of significant changes in the development and use of underwater sound gear for the identification and quantification of fish.

The Panel reconsidered its recommendation that FAO establish a directory of workers actively engaged in the use of underwater sound for fisheries research and decided that in view of the Register of Marine Scientists that FAO maintains, and the specialized lists of experts that are issued, as well as the envisaged establishment of an ad hoc Working Group of Experts on the Facilitation of Acoustics Research in Fisheries under ACMRR, such a special FAO directory is not required at this time.

2.23 Behaviour and physiology

The Panel was pleased to hear Dr. J. Hunter of the Southwest Fisheries Center present a report on the tuna related activities of the Center's Behaviour and Physiology Programme.

2.24 Collaboration with other Organizations

The Panel listened with great interest to a report by Dr. J. Joseph (U.S.A.) regarding international arrangements for the management of tuna. The report emphasized the need for a single body to coordinate research on tunas on a world-wide basis. In view of the coordination of tuna research that the Panel has fostered during its existence, the global nature of the problem and the absence of another adequate body, it was felt that the Panel should make immediate efforts to strengthen its role as a focus for tuna research coordination. The Panel therefore recommended to the Director-General of FAO that this be implemented by:

(a) continuing to encourage Panel members to attend international meetings related to tuna research and after consultation with the Chairman and the Secretariat, to represent the Panel at such meetings and report the results through the Secretariat;

(b) inviting to future meetings representatives from tuna regulatory bodies;

(c) encouraging increased intersessional activities of the Panel and its Working Parties.

The Panel further recommended that the Secretariat and those members attending the forthcoming ICCAT meetings represent the Panel, present the Report of this session and report the results of that meeting.

2.25 Law of the Sea Conference

The Panel noted that because of the timing of the forthcoming Law of the Sea Conference (1973), it would be unlikely that the Panel could actively assist FAO in preparing scientific and technical background on fishery resources for the Conference. However, the Panel offers its services to the Director-General, should the need arise.

2.26 Exchange of publications

The Panel agreed that its members would continue to exchange publications related to tuna research and send copies to the Secretariat. The Secretary was asked to distribute a list of tuna publications available in his office so that the Panel members will have an opportunity to supply FAO with additional publications not included in the holdings.

2.27 Education, training and exchange of workers

The Panel noted the continuing need for the education, training and exchange of workers, particularly from the developing countries. The Secretariat agreed to receive and subsequently distribute information from the Panel members on programmes in their respective countries designed to provide such opportunities.

3. OTHER BUSINESS

At the closing of the Session, the Chairman of the Panel, on behalf of all members, expressed the appreciation of the excellent facilities provided and the generous hospitality shown by the United States authorities, in particular by the NMFS Southwest Fisheries Center and the Tuna Research Foundation in La Jolla.

Appendix 1

INTERIM REPORT OF THE WORKING PARTY ON

TUNA EGGS, LARVAE AND JUVENILES

1. Introduction

The Working Party was set up to select a standard gear to collect tuna larvae, to develop keys for the identification of larvae and juveniles, and to investigate the identification of tuna eggs. The members are as follows:

Mr. W.M. Matsumoto, Convener (Honolulu)
Dr. S. Jones (Trivandrum)
Mr. W.L. Klawe (La Jolla)
Dr. W.J. Richards (Miami)
Dr. S. Ueyanagi (Shimizu)

During the intersessional period the Working Party concentrated its effort on gathering data and information necessary for the construction of keys to identify larvae and juveniles. The effort included the collection of juvenile tunas in midwater trawls, successful rearing of yellowfin larvae through artificial fertilization, and convening of a Larval Tuna Identification Workshop to clarify the identity of albacore (Thunnus alalunga). Except for the Workshop, all work was done by correspondence.

2. Collection of juveniles

A series of five cruises to equatorial central Pacific was made by the R/V TOWNSEND CROMWELL of the National Marine Fisheries Service, Southwest Fisheries Center, Honolulu Laboratory, along long. 145°W between lat. 12°N and 3°S from May 1969 through April 1970. On each cruise the modified Cobb pelagic trawl (mouth opening 12 x 8 m, 19 mm mesh netting with a large cod end section lined with 6.4 mm mesh netting) was used to collect juvenile tunas for taxonomic and other studies.

A total of 112 six-hour trawl hauls was made on the five cruises. Juvenile tunas were taken in 59 percent of the hauls in sizes ranging from 7.4 to 170 mm. A breakdown by species shows 808 Katsuwonus pelamis, 227 Thunnus spp., and 214 Auxis sp. or spp. Most of the juveniles (82.8 percent) were smaller than 30 mm. Of the Thunnus spp. only three were larger than 45 mm, not quite enough specimens for confident species identification. It is hoped that more specimens will be collected with continued use of the pelagic trawl.

3. Rearing of larvae

Artificial fertilization, hatching of eggs, and subsequent rearing of larvae was done successfully with yellowfin tuna during the summer of 1970 by the Far Seas Fisheries Research Laboratory, Shimizu, Japan, in cooperation with Kinki University.

1.27 million ripe eggs, whose diameters ranged between 0.90 and 1.04 mm (mode at 0.98 mm), from two mature yellowfin tuna taken in a purse seine set off Kii Peninsula, were fertilized on the seiner and transferred to a laboratory. The eggs hatched in 24-38 hours in water temperature of approximately 26°C. The larvae were reared in ½- and 1-ton capacity plastic tanks, as well as in larger, circular 15- and 35-ton capacity tanks. The water was aerated, but not circulated, and its temperature ranged between 25° and 28°C during the rearing period.

The newly hatched larvae were about 2.3 mm total length. They absorbed their yolk sac in three days and began to feed upon oyster larvae, rotifers and planktonic copepods, in the order given, as the larvae grew larger. Mortality was heavy at hatching, on the fifth to sixth day, and after the thirteenth day. The longest-lived larvae were reared for 20 days after hatching and were 8.5 mm total length.

Pigment patterns of the reared larvae - absence of black pigment spots on the dorsal and ventral edges of the trunk, presence of red pigment spots on the mid-ventral edge of the trunk, and presence of black pigment spots on the tip of the lower jaw - agreed with past descriptions of this species.

Because of inclement weather and sea conditions it was not possible to repeat the experiment this summer. However, in July 1971 ripe eggs of Auxis thazard were obtained off southern Izu Peninsula in set net. Eggs from several mature females were fertilized and approximately 8 000 larvae were hatched. The larvae were about 2.7 mm at hatching, similar to that of yellowfin. Almost all of the larvae died at the beginning of the postlarval stage and the longest-lived larvae (3.8 mm total length) were reared for 11 days.

At the NMFS Southeast Fisheries Center (formerly the Tropical Atlantic Biological Laboratory), Miami, Euthynnus alletteratus was successfully reared for 30 days after hatching from eggs obtained in plankton net tows. At the end of the rearing period, the juveniles had attained a standard length of 44.6 mm.

4. Larval Tuna Identification Workshop

In an attempt to resolve the conflicting views on the identity of Thunnus alalunga and to review the identification of larvae of other species of tunas, a Larval Tuna Identification Workshop was held at the Southwest Fisheries Center, Honolulu Laboratory, Hawaii on 2-6 March 1970. The Workshop afforded an opportunity to workers specializing in larval tuna identification to assemble specimens of various species of tunas and to examine these together. As time permitted, the status of juvenile tuna identification was examined also.

The participants included all members of the Working Party and Dr. E.H. Ahlstrom of the NMFS Southwest Fisheries Center in La Jolla. Dr. J.Y. Le Gall of the Centre Océanologique de Bretagne, Brest, France, attended the Workshop as an observer.

The report of the Workshop will be published in the next issue of the Fishery Bulletin of the National Marine Fisheries Service (U.S.A.). Arrangements have been made to have a condensed version published in the Russian language in Trudy AtlantNIRO.

5. Indexed bibliography

An "Indexed bibliography of the eggs and young of tunas and other scombrids (Pisces, Scombridae), 1880-1970" has been compiled by W.J. Richards and W.L. Klawe.

This bibliography, prepared in English, French, Spanish and German, enumerates reports on early life history of tunas and other scombrids published before 1971. The manuscript is scheduled for publication in the Special Scientific Report - Fisheries Series, of the National Marine Fisheries Service.

Appendix 2

BILLFISHES - STATUS OF THE RESOURCES AND SOME RESEARCH PROBLEMS

by

S. Ueyanagi

1. Billfishes in the Japanese tuna fishery

Billfishes (Istiophoridae and Xiphiidae) are known as "Kajiki-maguro", which literally means "billfish-tuna", and in the fishery and fish trade they are considered as "tuna". However, so far not much research has been carried out by Japanese fishery biologists, as the billfishes are not as important in the tuna fishery as are the members of the family Scombridae. Therefore, the number of scientific publications on billfishes is small (see appended literature).

The Japanese catch of billfishes amounts to only 15 to 20 percent of the total tuna longline catch of that country. Nevertheless the present domestic demand for billfishes equals that for tunas. Nearly all billfishes are caught by the longline fishery and only 5 percent of the total Japanese catch originates from the harpoon and set-net fisheries.

Raw meat of striped marlin is considered to be the best quality of the billfishes and its price equals that paid for the flesh of the more expensive tunas. The meat of billfishes, however, did not always command high prices. It is only since about 1966 that the price has increased remarkably. This can be attributed to the advancement in freezing techniques (in 1966 rapid deep freezing facilities became a standard part of new fishing vessels). This processing method had a great influence on the demand for the flesh of billfishes in Japan, which almost overnight began to be consumed as "sashimi" (raw fish) just as are the other tunas. Prior to that time the billfishes were utilized largely for fish sausages.

2. Recent status of the billfish resources

Trends for the world and Japanese catches for the more recent years are shown in Figure 1. It can be seen that the world production of billfishes increased up to 1965 when about 110 000 metric tons were landed. Since then the catches have declined. Japanese fishermen have been catching on an average about 70 percent of the global production. A decrease in the Japanese catch also began in 1966. Since 1968 the annual Japanese catch of billfishes has been in the neighbourhood of 70 000 tons and the world catch around 100 000 tons. The Japanese catch, however, has been declining more rapidly than that of the rest of the world. This can be attributed to the geographical shifting of the fishing effort. Since 1966 many of the Japanese tuna longliners have begun to concentrate on the fishing grounds in which abound the southern bluefin tuna and where the billfishes are caught infrequently.

Regardless of the recent changes in the distribution of the Japanese fishing effort for billfishes and tunas, it appears that the billfish resources of the world oceans have been nearly fully exploited and some species, such as the blue marlin, are considered to be fished very heavily in all three oceans. Generally speaking, the status of the billfish resources is clearly in need of stock assessment studies.

3. Some billfish research problems

3.1 Catch and effort statistics

The Japanese and Taiwanese tuna longline fishery statistics list the catches of billfishes in the same manner as the tunas. Mostly, the catch data for billfishes are available by species, but this is not always the case. Thus, the name of "striped marlin" is applied equally to the true striped marlin of the Indo-Pacific region as well as to the

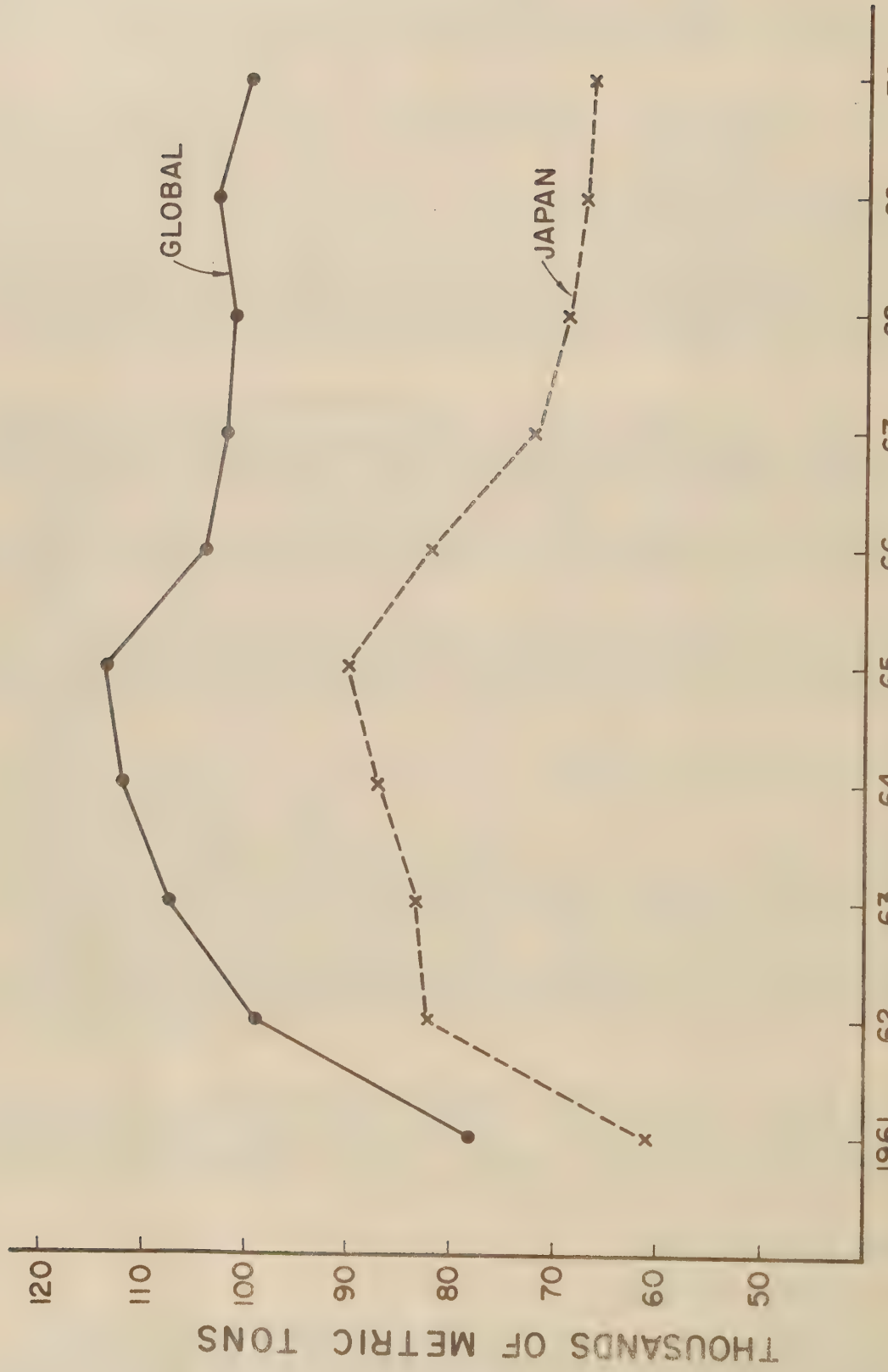

Figure 1: Total landings of billfishes 1961-70 : in the world (solid line) and in Japan (dotted line)

white marlin from the Atlantic Ocean. However, as the statistics give data for the different oceans this does not pose a serious problem and the data for the two species can be readily separated. The catches of spearfishes and sailfishes are combined in the "Annual Report of Effort and Catch Statistics by Area on Japanese Tuna Longline Fishery", and a separation by species is not possible. There is also a problem with the catch statistics of the black and blue marlin as the amounts for both species are combined and listed as such in the "Yearbook of Fishery and Aquaculture Products in Japan" as well as in the FAO's "Yearbook of Fishery Statistics". Special efforts are being made in Japan to solve this problem and in the future the data on blue marlin and black marlin caught by Japanese fishermen will be listed separately.

3.2 Body length measurements

A discrepancy exists in the manner in which the body length of billfishes is measured in the United States and in Japan. In the United States the method of Dr. L.R. Rivas is generally employed, measuring the fork length (direct distance from the tip of the lower jaw to the tip of the midray of the caudal fin). In Japan the body length is measured as the eye fork length (direct distance from the posterior margin of the orbit to the tip of the midray of the caudal fin). Japanese researchers chose this method because commercially landed fish are brought to the ports partially or wholly dressed and in this process the anterior portion of the head is invariably cut off. The lack of agreement between the two methods of measurement will have to be resolved.

3.3 Species identification

(a) Adults:

There is general agreement on the specific identity of the adult billfishes caught in various world oceans, with the exception of the sailfish (Istiophorus albicans) and the blue marlin (Makaira nigricans). This problem, although of interest to ichthyologists, is not too serious as the fish in question can be readily separated on a geographical basis. The distribution of the black marlin in the Atlantic Ocean needs clarification.

(b) Larvae and juveniles:

The problem is now under review by the newly established Working Party on the Early Life History of Billfishes under the FAO Tuna Panel.

3.4 Stock identification

The striped marlin in the Pacific and the white marlin as well as the blue marlin in the Atlantic, because of their commercial importance and their problematic population structure, present themselves as primary targets for a study on the stock identification. Tagging, serological and biochemical studies would be the tools needed for an integrated interdisciplinary approach.

3.5 Age determination

Age determination in billfishes using scales and other hard parts has not as yet been accomplished. A study of the feasibility of employing the scales or bones for age and growth determinations should be encouraged.

4. Literature

Reports on billfish studies published in Japanese journals since 1962.

Taxonomy, Species identification, Early life history

Nakamura, I., T. Iwai and K. Matsubara, A review of the sailfish, spearfish, marlin and swordfish of the world. Spec.Rep.Misaki Mar.Biol.Inst.Kyoto Univ., (4):1-95 1968

Ueyanagi, S., On the larvae of the shortnosed spearfish. Tetrapturus angustirostris Tanaka. Rep.Nankai Reg.Fish.Res.Lab., (16):173-89 1962

_____, Methods for identification and discrimination of the larvae of five istiophorid species distributing in the Indo-Pacific. Rep.Nankai Reg.Fish. Res.Lab., (17):137-50 1963

_____, A study of the relationships of the Indo-Pacific istiophorids. Rep.Nankai Reg.Fish.Res.Lab., (17):151-65 1963a

Ueyanagi, S. and H. Watanabe, On certain specific differences in the vertebrae of the istiophorids. Rep.Nankai Reg.Fish.Res.Lab., (22):1-8 1965

Watanabe, H. and S. Ueyanagi, Young of the shortbill spearfish, Tetrapturus angustirostris Tanaka. Rep.Nankai Reg.Fish.Res.Lab., (17):133-6 1963

Distribution, Relative abundance, Size composition, Spawning, Feeding, Growth, etc.

Honma, M. and Z. Suzuki, Distribution and catch amount of striped marlin by the Japanese longline fishery in the Pacific Ocean, 1960-1966. Tuna Fish., (82):9-22 1969

Kikawa, S. et al., Status of tuna fisheries in the Indian Ocean as of 1968. S-Ser.Far Seas Fish.Res.Lab., (2):1-28 1969

Kobayashi, H. and Y. Yamaguchi, Feeding ecology and the hooking tendency of tunas and marlins in the eastern Equatorial Pacific. Bull.Jap.Soc.Sci.Fish., 37(2):83-9 1971

Koto, T., Some considerations on the growth of marlins, using size-frequencies in commercial catches. 3. Attempts to estimate the growth of striped marlin, Tetrapturus audax (Philippi) in the western North Pacific Ocean. Rep.Nankai Reg.Fish.Res.Lab., (17):63-85 1963

_____, Annual variations in the growth of striped marlin, Tetrapturus audax (Philippi) in the western North Pacific Ocean. Rep.Nankai Reg.Fish.Res.Lab., (17):87-102 1963a

Koto, T. and K. Kodama, Some considerations on the growth of marlins using size-frequencies in commercial catches. 1. Attempts to estimate the growth of sailfish. Rep.Nankai Reg.Fish.Res.Lab., (15):97-108 1962

_____, Some considerations on the growth of marlins, using size-frequencies in commercial catches. 2. Attempts to estimate the growth of so-called white marlin, Marlina marlina, (J. and H.). Rep.Nankai Reg.Fish.Res.Lab., (15):109-26 1962a

Kume, S. and J. Joseph, Size composition and sexual maturity of billfish caught by the Japanese longline fishery in the Pacific Ocean east of 130°W. Bull.Far Seas Fish.Res.Lab., (2):115-62 (in English) 1969

Nakagome, J., 1965 On the seasonal variations of swimming layer of yellowfin tuna, big-eyed tuna and blue marlin in the area of Caroline and Marshall Islands. 5. Relation between seasonal variation of depth of swimming layer and that of depth of water temperature layer. Bull.Jap.Soc.Sci.Fish., 31(10):785-8

Shiohama, T., 1969 A note on the marlins caught by tuna longline fishery in the eastern Pacific Ocean east of 130°W. Bull.Far Seas Fish.Res.Lab., (1):5-34

Shiohama, T., M. Myojin and H. Sakamoto, 1965 The catch statistic data for the Japanese tuna longline fishery in the Atlantic Ocean and some simple considerations on it. Rep.Nankai Reg.Fish.Res.Lab., (21):1-131

Ueyanagi, S., 1966 Symposium on tuna fisheries. Part 1. Biology of tunas and billfishes. Bull.Jap.Soc.Sci.Fish., 32(9):739-55

Ueyanagi, S. et al., 1970 Distribution, spawning, and relative abundance of billfishes in the Atlantic Ocean. Bull.Far Seas Fish.Res.Lab., (3):15-55

Appendix 3

PRIORITY FOR SPECIES SYNOPSES ON TUNAS, TUNA-LIKE SPECIES AND BILLFISHES

The priority order should be based on:

(1) Commercial importance (present and/or potential)
(2) Amount of available information to summarize

First level - urgent priority - worldwide coverage:

Thunnus albacares - yellowfin
T. obesus - big-eye
T. alalunga - albacore
T. thynnus - bluefin
T. maccoyii - southern bluefin
Katsuwonus pelamis - skipjack

For these six species a prime author-editor should be selected to integrate the existing species accounts and then send the resulting draft to co-authors (reviewers) in other regions for additions and changes.

Second level - preparation desirable if and when possible:

1. *Sarda sarda* - Atlantic bonito
2. *S. chiliensis* - bonito
3. *T. tonggol* - longtail
4. *E. affinis* - Indo-W. Pacific little tuna
5. *Euthynnus alletteratus* - little tunny
6. *T. atlanticus* - blackfin
7. *Gasterochisma melampus* - large scale tuna
8. *Allothunnus fallai* - slender tuna
9. *E. lineatus* - black skipjack

Synopses on billfishes (preparation already being arranged):

Xiphias gladius - broadbill swordfish
Makaira nigricans - blue marlin
M. indica - black marlin
Istiophorus platypterus - sailfish
Tetrapturus audax - striped marlin
T. albidus - white marlin
T. angustirostris - shortbill spearfish
T. belone - Mediterranean spearfish
T. pfluegeri - longbill spearfish

Appendix 4

PARTICIPANTS AND OFFICERS OF THE MEETING

PARTICIPANTS

Members of the Panel*

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* Prof. E. Postel (France) was unable to attend

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FAO

Dr. D. Sahrhage
Chief, Marine Biology and Environment Branch
Fishery Resources Division
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Mr. I. Barrett, Acting Director
Dr. A. Alvariño de Leira, Fishery Biologist
Dr. N.E. Clark, Meteorologist
Dr. W.H. Lenarz, Fishery Biologist
Mr. G.T. Sakagawa, Fishery Biologist
Dr. J.R. Hunter, Fishery Biologist

Inter-American Tropical Tuna Commission, La Jolla:

Mr. W.L. Klawe, Senior Scientist
Mr. C.J. Orange, Senior Scientist
Mr. G.D. Sharp, Associate Scientist

Scripps Tuna Oceanography Research Program, Institute of Marine Resources, La Jolla:

Dr. F. Williams, Associate Research Biologist

OFFICERS OF THE MEETING

Chairman	A. Suda (Japan)
Rapporteur	F.J. Hester (U.S.A.)
Technical Secretary	D. Sahrhage (FAO)
Liaison Officer	I. Barrett (U.S.A.)
Assistant	L. Vlymen (U.S.A.)
Stenographer	M. DuBois (U.S.A.)

Appendix 5

LIST OF DOCUMENTATION AT PANEL

Working Papers

FIR:EPFTR/71/1	Provisional Agenda with Annotation
/2	Report of Third Session of the Panel of Experts for the Facilitation of Tuna Research, Cadiz, 7-10 October 1969
/3	Second Interim Report of the Working Party on Tuna and Billfish Tagging in the Pacific and Indian Oceans
/4	Final Report of the Working Party on Tuna and Billfish Tagging in the Atlantic and Adjacent Seas
/5	Interim Report of the Working Party on Tuna Eggs, Larvae and Juveniles
/6	Note on Working Party on the Early Life History of the Billfishes
/7	Note on Working Party on Tuna Taxonomy
/8	Report of the Meeting of a Group of Experts on Tuna Stock Assessment, Miami, 12-16 August 1968
/9	Nominal Catches, by Species, by Fishing Areas and by Countries. - Table B3-6: Tunas, Bonitos, Billfishes, etc.
/10	Note on FAO Species Synopses on Tuna and Related Species
/11	Note on FAO Species Identification Sheets for Statistical Purposes concerned with Tuna and Related Species
/12	Draft Report of the Fourth Session of the FAO Panel of Experts for the Facilitation of Tuna Research

Information Papers

FIR:EPFTR/71/Inf. 1	Information for Participants
Inf. 1 Suppl. 1	Time Table
/Inf. 2	List of Members of the Panel of Experts for the Facilitation of Tuna Research and of its various Working Parties
/Inf. 3	List of Documents
/Inf. 4	Report of the IOFC Working Party on Stock Assessment in Relation to immediate Problems of Management in the Indian Ocean, Rome, 30 September-3 October 1969
/Inf. 5	Report of the Joint Meeting of the IPFC Special Committee on Management of Indo-Pacific Tuna and the IOFC Committee on Management of Indian Ocean Tuna, Rome, 22-23 April 1971
/Inf. 6	A Prospectus on IGOSS
/Inf. 7	Summary of Activities of the Fishery-Prediction Research and Development Group at the Fishery Oceanography Center, La Jolla, California
/Inf. 8	International Commission for the Conservation of Atlantic Tunas (ICCAT) Report of Sub-Committee on Stock Assessment, Madrid, 1970
/Inf. 9	International Arrangements for the Management of Tuna - a World Resource (J. Joseph)
/Inf. 10	Report of the Recent Activities on Tuna Research in Japan, with Supplementary Information on those of Taiwan
/Inf. 11	Recent Works (for ten years) on Billfish and Study Published in the Japanese Bulletins and Magazines since 1962
/Inf. 12	Report of the "Instituto del Mar del Perú" and other Institutes of Fishery Investigations from South America for the Fourth Session of the FAO Panel of Experts for the Facilitation of Tuna Research

/Inf. 13	Revisión de la pesquería del Bonito en aguas peruanas
/Inf. 14	Records of Sarda velox (Meek and Hildebrand)
/Inf. 15	Distribution of eggs and larvae of "caballa" Scomber japonicus peruanus (Jordan and Hubbs) in the Peruvian coast
/Inf. 16	Distribution of Tuna in Relation to General Oceanographic Conditions off Chile and Peru during the First Three Months of the Year
/Inf. 17	Preliminary Observations on the Biology and Fishery Dynamics of the Bonito (Sarda chiliensis) in Chilean Waters
/Inf. 18	Tuna-Related Activities at the Southwest Fisheries Center
/Inf. 19	Notes on the Northwestern Atlantic Bluefin Tuna Stock
/Inf. 20	Review of the Bluefin Tuna Fisheries and Research in the Norwegian Coastal Waters and Adjacent Seas
/Inf. 21	Bref Exposé sur la Recherche Thonière française du 1/1/1968 au 29/9/1971

Appendix 6

LIST OF WORKING PARTIES

1. TUNA AND BILLFISH TAXONOMY

Dr. B.B. Collette (U.S.A.) Convener
Mr. J.E. Fitch (U.S.A.)
Dr. R.H. Gibbs (U.S.A.)
Dr. I. Nakamura (Japan)
Prof. E. Postel (France)
Dr. B.J. Rothschild (U.S.A.)
Dr. H.G. Silas (India)
Dr. F.H. Talbot (Australia)

2. TUNA EGGS, LARVAE AND JUVENILES

Mr. W.M. Matsumoto (U.S.A.) Convener
Dr. S. Jones (India)
Mr. W.L. Klawe (U.S.A.)
Dr. W.J. Richards (U.S.A.)
Dr. S. Ueyanagi (Japan)

3. EARLY LIFE HISTORY OF THE BILLFISHES

Dr. S. Ueyanagi (Japan) Convener
Dr. D.P. De Sylva (U.S.A.)
Dr. N.N. Gorbunova (U.S.S.R.)
Mr. W.L. Klawe (U.S.A.)
Mr. S.N. Tibbo (Canada)

4. TUNA AND BILLFISH TAGGING IN THE PACIFIC AND INDIAN OCEANS

Dr. W. Bayliff (U.S.A.) Convener
Mr. J. Isa (Ryukyu Islands)
Dr. S. Kikawa (Japan)
Mr. M. Legand (New Caledonia)
Mr. T. Otsu (U.S.A.)
Dr. H.G. Silas (India)
Mr. P.T. Wilson (U.S.A.)
Prof. Yang Rong-tzong (Republic of China)
Mr. M. Yao (Japan)

5. TUNA AND BILLFISH TAGGING IN THE ATLANTIC AND ADJACENT SEAS (now disbanded)

Mr. F.J. Mather III (U.S.A.) Convener
Dr. J. de Ciechomski (Argentina)
Mr. J. Collignon (Morocco)
Dr. J.R. Gonzáles (Cuba)
Mr. R.C. Griffiths (FAO, Venezuela)
Mr. J. Hamre (Norway)
Dr. S. Kikawa (Japan)
Mr. E.A. Kwei (Ghana)
Dr. J.C. Le Guen (France)
Dr. S. Moura (Brazil)
Mr. A. Percier (France)
Dr. J. Rodríguez-Roda (Spain)
Mr. G.H. Stander (South Africa)
Mr. S.N. Tibbo (Canada)
Dr. K. Tiews (Federal Republic of Germany)
Dr. J. Troadec (Ivory Coast, now FAO, Rome)
Dr. H.Z. Vilela (Portugal)

6. PRIORITY TABLES

Dr. J.C. Le Guen (France) Convener
Dr. J. Joseph (U.S.A.)
Dr. A. Suda (Japan)

MR/C8144/5.72/E/1/800